REMARKS

Claims 1 and 11 have been amended. Claims 1 through 19 remain in the application.

35 U.S.C. § 102(b)

Claims 1 through 19 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kanai et al. "A Virtual Verification Environment for the Sequence Control System Using VRML and JAVA", 1999 by ASME, pgs. 1 through 8. Applicants respectfully traverse this rejection.

Kanai et al. discloses a virtual verification environment for a sequence control system using VRML and JAVA. Sequence control is one of the key components of realizing the various kind of current automated factory equipment. Building the system components in the equipment and programming the control code in a PLC are two major activities in developing the sequence control system. VRML2.0 was originally designed as the standard specification language of 3-D geometry and its dynamic behaviors. It can be executed on any platform and any operating system. There are many VRML viewers and authoring tools commercially available, and they are much less expensive than the commercial discrete-event simulators. The specification of VRML includes the behavioral mechanism of the scene based on the event cascade. The execution engine is also installed in all VRML viewers. The language format is specified as the ISO/IEC international standard. The language can be executed in any operating system, and can be easily imported through networks. Generally, the sequence control system can be modeled as a set of finite state machines. State variables, input variables, and output variables of each component model can be defined as fields in the prototype node of the VRML. The state transitions of each model can be also described in the script nodes by combining the

external JAVA code with the VRML. 3-D geometry of the components, their motion behaviors corresponding to the state transition of the component can be easily defined by adding the several standard nodes of VRML in the code. Inexpensive VRML viewer can be used for the visual verification of the co-simulation. Kanai et al. does not disclose the steps of generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer and viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer. Kanai et al. also does not disclose the steps of using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator.

In contradistinction, independent claim 1, as amended, clarifies the invention claimed as a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle. The method includes the steps of constructing a mechanical model using a computer, generating transformational arrays for the mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using the computer, viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer, and determining whether the motion of the mechanical model is acceptable. The method also includes the steps of replicating the motion of the mechanical model by generating a PLC code for the motion of the mechanical model using the computer if the motion of the mechanical model was acceptable and using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator. Independent claim 11 is similar to claim 1 and includes other features of the present invention.

A rejection grounded on anticipation under 35 U.S.C. § 102 is proper only where the subject matter claimed is identically disclosed or described in a reference. In other words, anticipation requires the presence of a single prior art reference which discloses each and every element of the claimed invention arranged as in the claim. In re Arkley, 455 F.2d 586, 172 U.S.P.Q. 524 (C.C.P.A. 1972); Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983); Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co., 730 F.2d 1452, 221 U.S.P.Q. 481 (Fed. Cir. 1984).

Kanai et al. does not disclose or anticipate the claimed invention of claims 1 through 19. Specifically, Kanai et al. merely discloses a virtual verification environment for a sequence control system using VRML and JAVA in which the sequence control system can be modeled as a set of finite state machines and state variables, input variables, and output variables. Kanai et al. lacks the steps of generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer and viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer to determine whether the motion of the mechanical model is acceptable. In Kanai et al., during, co-simulation, there is a series of snapshots on the VRML viewer, however, there are no transformational arrays for the mechanical model that are generated by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time prior to the co-simulation on the VRML viewer to determine if the motion of the mechanical model is acceptable. The snapshots and transformational arrays are not analogous and the Examiner has misinterpreted the Kanai et al. reference.

Kanai et al. also lacks the steps of using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the

PLC code with a PLC emulator. In Kanai et al., there is no PLC emulator to play the PLC code such that the user can observe the motion of the mechanical model using the actual PLC code as if they were watching a machine or manufacturing line of a vehicle assembly plant floor as claimed by Applicants. The Examiner admits on page 4 of the Office Action that Kanai et al. does not teach or disclose a PLC emulator explicitly. Therefore, the claims are allowable over Kanai et al. on that basis alone.

The present invention is a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle that allows a controls engineer to compare the behavior of the PLC code to accepted motion of a CAD model as part of PLC logical verification system and uses transformational arrays that allows a different software technology to do the rendering; one that requires much less computer resource per unit of machine; and allows a controls engineer to examine the visual behavior of an entire manufacturing line, thereby verifying some of the more difficult controls problems such as inter-workcell behavior through observation of the visual operation of multiple concurrent workcells. Kanai et al. fails to disclose the combination of a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle including the steps of constructing a mechanical model using a computer, generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using the computer, viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer, determining whether the motion of the mechanical model is acceptable, replicating the motion of the mechanical model by generating a PLC code for the motion of the mechanical model using the computer if the motion of the mechanical model was acceptable, and using the accepted motion of the mechanical model to

compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator as claimed by Applicants. Therefore, it is respectfully submitted that claims 1 through 19 are allowable over the rejection under 35 U.S.C. § 102(b).

Based on the above, it is respectfully submitted that the claims are in a condition for allowance, which allowance is solicited.

Respectfully submitted,

By: ______________________
Daniel H. Bliss
Registration No. 32,398

BLISS McGLYNN, P.C.
2075 West Big Beaver, Suite 600
Troy, Michigan 48084
(248) 649-6090

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